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# URANIUM FACT SHEET

| Contaminant | In Water As | Maximum Contaminant Level |
|---|---|---|
| **Uranium (U)** | $UO_2(CO_3)_2^{-2}$<br>$UO_2(CO_3)_3^{-4}$ | **US EPA:**<br>MCL* = 0.030 mg/L (or ppm)<br>MCLG** = zero mg/L (or ppm)<br>**WHO† Guideline** = 0.030 mg/L |
| **Sources of Contaminant** | Naturally occurring mineral | |
| **Potential Health Effects** | Kidney toxicity<br>Increased risk of cancer | |
| **Treatment Methods**<br>**Point-of-Entry (POE)**<br>**Point-of-Use (POU)** | Strong Base Anion Exchange Resins ($Cl^-$ form)<br>Reverse Osmosis<br>Distillation | |

*Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

**Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.

WHO† - World Health Organization

Uranium is a common naturally occurring and radioactive substance. It is a normal part of rocks, soil, air, and water, and it occurs in nature in the form of minerals - but never as a metal. Natural uranium is a mixture of three types or isotopes called U-234 ($^{234}U$), U-235 ($^{235}U$), and U-238 ($^{238}U$). All three are the same chemical, but they have different radioactive properties. The isotope $^{235}U$ is useful as a fuel in power plants and weapons.

Uranium enters water by leaching from soil and rocks, or in releases from processing plants. Release of uranium from human activities are due accidents of different nature. Larger particles settle into the bottom of lakes, rivers, and ponds and join uranium that is there naturally. Uranium is present in water supplies as anionic complexes, $UO_2(CO_3)_2^{-2}$ and $UO_2(CO_3)_3^{-4}$.

## HEALTH EFFECTS

Uranium has demonstrated toxic effects on human kidneys leading to kidney inflammation and changes in urine composition. Uranium can decay into other radioactive substances, such as radium, which can cause cancer with extensive exposures over a long enough period of time (US EPA, 2013).

The US EPA has issued a Maximum Contaminant Level Goal of zero and a Maximum Contaminant Level (MCL) of 0.030 mg/L for uranium. The 0.030 mg/L is based on increased risk of kidney toxicity and is equivalent to about 27 picocuries per liter (pCi/L) of radioactivity, which also presents an increased risk of cancer from uranium. The U.S. EPA feels the 0.030 mg/L MCL will protect against both cancer risk and risk of kidney damage.

## TREATMENT METHODS

| | |
|---|---|
| **Residential**<br>**Point-of-Entry**<br>**Point-of-Use** | Strong Base Anion Exchange Resins ($Cl^-$ form)<br>Reverse Osmosis<br>Distillation |
| **Municipal** | Reverse Osmosis<br>Ion Exchange<br>Lime softening<br>Coagulation/filtration |

Strong base anion exchange resins, Type I and Type II, have a strong affinity for the uranium complexes and can remove them effectively to meet the MCL requirement. Cation exchange resins are not effective for the removal of uranium. Reverse osmosis and distillation are also potentially effective techniques for reducing uranium levels.

There are presently no protocols in any of the NSF/ANSI Standards for reducing the uranium levels from water. Thus, the treatment methods listed are generally recognized as techniques that can effectively reduce uranium sufficiently to meet or exceed the MCL. However, this list does not reflect the fact that POU/POE devices and systems currently on the market may differ widely in their effectiveness in treating specific contaminants and performance may vary from application to application. Therefore, selection of a particular device or system for uranium reduction should be made only after a careful investigation of its performance capabilities based on results from competent equipment validation testing for the specific contaminant to be reduced.

As part of the installation procedure, system performance characteristics should be verified by tests conducted under established test procedures and water analysis. Thereafter, the resulting water should be monitored periodically to verify continued performance. The application of the water treatment equipment must be controlled diligently to ensure that acceptable feedwater conditions and equipment capacity are not exceeded.

Visit WQA.org to find water professionals in your area. Note that Certified Water Specialists have passed the water treatment educational program with the Water Quality Association and continue their education with recertification every 3 years.

## REGULATIONS

In the United States the EPA, under the authority of the Safe Drinking Water Act (SDWA), has set the Maximum Contaminant Level Goal (MCLG) for uranium at zero mg/L (or ppm). This is the health-based goal at which no known or anticipated adverse effects on human health occur and for which an adequate margin of safety exists. The US EPA has set Maximum Contaminant Level (MCL) for uranium in drinking water at 0.030 mg/L. The utility must take certain steps to correct the problem if the tap water exceeds the limit and they must notify citizens of all violations of the standard.

## REFERENCES/SOURCES

US EPA (September 17, 2013). "Basic Information about Radionuclides in Drinking Water," Retrieved from http://water.epa.gov/drink/contaminants/basicinformation/radionuclides.cfm.

World Health Organization (2004)."Uranium in Drinking Water". Retrieved from http://www.who.int/water_sanitation_health/dwq/chemicals/en/uranium.pdf.

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